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Study on Knowledge Level of Paddy Farmers on Climate Change in Nagapattinam District of Tamil Nadu, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study examined the Knowledge level of Paddy farmers on Climate Change the Nagapattinam district of Tamil Nadu state in India. It is situated in the coastal area and is very often subjected to natural calamities which were mainly reflected in the Paddy cultivation to the worst status. The ex-post facto research design was used in this research study. A sample size of 200 was fixed for the study. The data were collected with the use of a well-structured and pre tested interview schedule for farmers covering all the aspects of knowledge on Climate change. The respondents' knowledge level of climate change was measured by designing exclusively the knowledge test. The study revealed that more than half of the respondents (55.00%) had a medium level of knowledge of

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climate change. Nearly one-third (32.50%) of the respondents had a high level of knowledge and a lesser number of respondents (12.50%) were found to be under the category of low- level knowledge. Educational status, farming experience, contact with extension agencies, information seeking behaviour, social participation, innovativeness, risk orientation and awareness had shown positive and significant associations with paddy farmers knowledge and these variables contributed to improving the knowledge level of the Paddy farmers on climate change. They had knowledge of changes in the rainfall patterns, extreme climatic events, changes in the crop growths stages, ground water table and pest and disease outbreaks but the famers don't have enough knowledge on climate change adaptation strategies in Paddy cultivation with respect to tackle the problem of salinity, sodicity and effects of humidity in grain filling to cope up with climate change. Hence, it is recommended that special training programmes may be frequently offered in the study area to improve the knowledge and skill of the farmers on climate change.

Keywords: Climate change; knowledge test; paddy; Coastal area; Nagapattinam district.

1. INTRODUCTION

"Changing and increasingly variable climate is an important issue realized as a formidable challenge to ensuring food security in developing countries and engaging the global community, adding the dimensions of urgency and complexity to the problems of rainfed agriculture. It is observed that the incidence of extreme climatic events such as droughts and floods is likely to increase in the coming decades making agriculture in much more jeopardy" [1].

"Though India has achieved self-sufficiency in food-graining production through Green Revolution, it brought a host of environmental challenges like loss of soil fertility, waterlogging, water pollution, intensified pests, and fluctuation in farm input price" [2]. "In addition to all these, climate change has added a new dimension to the existing problems by posing a significant threat to Indian agriculture in general and food security in particular" [3]. "India is also identified as one of the highly vulnerable to temperatures, frequent heat waves, droughts, extreme precipitation events, and intense cyclonic activities" [4,5]. "Agriculture and the allied sectors are directly and highly affected by climate change and which resulted in effects production of agriculture, water availability, soil fertility, and pests" [6]. "The overall effect of climate change on agriculture could be positive or negative; the magnitude of impact can also vary from very low to very high, depending on regional or geographical locations and the status of socioeconomic development" [7,8,9].

Hence, it is necessary for the farmers to have enough knowledge about climate change to combat these adversities. Knowledge has been referred to as the body of information possessed by an individual which is in accordance with the established fact. The body of information possessed by individuals influences them to behave in a particular manner. Knowledge is a prerequisite for the adoption of innovation, as this would enable the farmers to completely understand technology and its relative advantage. Hence, an attempt was to conduct a research study with the objective to study Knowledge Level of Paddy Farmers on Climate Change in Nagapattinam District.

2. METHODOLOGY

The choice for selection of the district had fallen on the coastal ecosystems of Tamil Nadu state for the conduct of the present study. Coastal belts are more prone to the devastating impact of climate change. The geographical setting of Tamil Nadu makes the state vulnerable to natural disasters such as cyclones [10], floods, and earthquake-induced tsunamis. Among the 29 districts of Tamil Nadu, Nagapattinam district is very often subjected to natural calamities which were mainly reflected in the paddy cultivation to the worst status. "Since the last few years, the district has high range of variability in rainfall and temperature. The district is one among those districts having more area under paddy cultivation. The district has eleven blocks, of which five blocks viz Thalainayar, Kuttalam, Mayiladuthurai, Kilvelur, and Sembanar Koil were selected based on the maximum area covered under paddy cultivation and high range of variability in rainfall and temperature. In order to select the villages for the study, the list of revenue villages in each of the five selected blocks was collected. Five villages from each of the selected blocks were identified purposively based on the maximum area under paddy cultivation. The respondents for the present

study were paddy farmers from the selected villages. A sample size of 200 was fixed for the study" [11]. The sample was proportionately allotted in each of all the selected blocks of Nagapattinam district. Accordingly a sample of 40 paddy farmers was selected from each of the 5 blocks.

A research design is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in the procedure [12]. In the broader sense, the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement, and analysis of data.

For this study, *ex-post-facto* type of research design was used. In this type of research, instead of creating a treatment, the researcher evaluated the effects of a statistically occurring phenomenon after its occurrence. Climate change, is an ever-existing recurrent phenomenon in the study area over a period of time and hence the *ex-post-facto* type of research was employed.

The data collection was done with the use of a well-structured and pre-tested interview schedule for farmers covering all the aspects of knowledge on Climate change. The knowledge level of the respondents about climate change was measured by designing exclusively the knowledge test. The details of the steps involved the designing the knowledge test are given below. The technologies were identified by having discussions with scientists and the available works of literature.

2.1 Item Collection

A list of items seeking knowledge about climate change was prepared from the already identified climatic factors with the help of experts from Tamil Nadu agricultural university.

2.2 Item Analysis

The selected items were administered to 15 respondents in the non-sampling area. Scores of 2 and 1 were given to "correct" and "incorrect" answers, respectively. The total score for each respondent was calculated. Afterward, the total scores of the respondents were arranged in descending order. As suggested by Singh [13], 27 percent of the upper groups constituted "high group" and 27 percent of the bottom group as "low group". The score of these two groups was considered for calculating item difficulty and item discrimination indices.

2.3 Difficulty Index

The difficulty index was computed by averaging the proportion of correct answers in the high group and the proportion of correct answers in the low group. The formula for determining the index on the basis of the extreme group is as under.

$$P = \frac{R_U + R_L}{N_U + N_L}$$

Where

P is the index of difficulty
R_U is the number of examinees answering correctly in the upper group
R_L is the number of examinees answering correctly in the lower group
N_U is the number of examinees in the upper group
N_L is the number of examinees in the lower group

2.4 Discrimination Index

The discrimination index is referred to the extent to which an item discriminates well-informed individuals from poorly-informed ones. It was evaluated using the 'Net D index of discriminations', which had been defined as an unbiased index of absolute difference in the number of discriminations made between the upper group and the lower group, it is proportional to the net discriminations made by the item between the two groups, i.e., the difference between the proportion of correct answers of the high/upper group 27 percent and low group 27 percent examinees.

$$V = \frac{R_U}{N_U} - \frac{R_L}{N_L}$$

Where

R_U is the number of examinees answering correctly in the upper group.
R_L is the number of examinees answering correctly in the lower group.
N_U is the number of examinees in the upper group.

N_L is the number of examinees in the lower group.
V is the discriminating power or validity

2.5 Item Selection

The difficulty index and discriminatory index were the criteria for the selection of items for the test to start with the items having a difficulty index of 0.4 to 0.6 and a discrimination index of above 0.4 were selected.

2.6 Item Administration

The selected items were administrated to the respondents in the study area. For correct answers, a score of 2 was given, and for incorrect answers a score of 1 was given. The knowledge level of the respondents was calculated by using the formula followed by Madhan [14].

The formula used for the calculation of the knowledge index of each respondent was

$$\text{Knowledge index} = \frac{K}{P} \times 100$$

Where

K= Knowledge scores obtained by an individual respondent
P= Maximum possible scores for all items

The respondents were classified into three categories such as low, medium, and high using the mean and standard deviation.

2.7 Descriptive Statistics

According to Hejase and Hejase (2013), "descriptive statistics deals with describing a collection of data by condensing the amounts of data into simple representative numerical quantities or plots that can provide a better understanding of the collected data" [15]. Therefore, this study analysed data collected with descriptive statistics such as frequencies and percentages supported with tables for clarity.

3. RESULTS AND DISCUSSION

In order to assess the knowledge level of the respondents, necessary data were collected and they were categorized into three categories viz., low, medium, and high based on the overall score obtained in the knowledge test. The distribution of respondents according to their knowledge level of climate change is presented in Table 1.

Table 1. Distribution of respondents based on their knowledge level

S. No.	Category	Frequency	Percent, %
1.	Low	25	12.50
2.	Medium	110	55.00
3.	High	65	32.50
	Total	**200**	**100.00**

Note: n = 200.

It could be inferred from Table 1, that more than half of the respondents (55.00%) had a medium level of knowledge of climate change. Nearly one-third (32.50%) of the respondents had a high-level of knowledge and a lesser number of respondents (12.50%) were found to be under the category of low-level knowledge.

The appropriate reason for a medium to a higher level of knowledge of climate change might be due to the fact that the majority of them were literate, with a medium to a higher level of extension agency contacts and social participation. In addition to this most of the farmers had medium to high levels of awareness of climate change. In order to increase their income this would have aroused their interest to acquire more knowledge. Further, the extension personnel from government and Non-Governmental Organisations also played an important role in both extension and educational activities. Due to this reason, the knowledge of climate was medium to high among the respondents.

This finding corroborates the findings of Jayasree (2004), who also reported that the majority of the paddy farmers had a medium level of knowledge of recommended water management practices [16].

3.1 The Association and Contribution of the Profile of Paddy Farmers with their Knowledge level

The results of correlation and multiple regression analysis between the profile of paddy farmers and knowledge have been presented in Table 2.

Table 2. Correlation and multiple regression analysis of the profile of paddy farmers with their knowledge level

V. No.	Name of variables	'r'	Regression coefficient	Std. Error	't' value
1.	Age	0.132	0.168	0.172	0.978^{NS}
2.	Educational status	0.418^{***}	0.339	0.110	3.092^{***}
3.	Annual income	0.134	0.145	0.177	0.819^{NS}
4.	Occupation	0.121	0.069	0.130	0.532^{NS}
5.	Area under rice cultivation	0.126	0.154	0.169	0.914^{NS}
6.	Farming experience	0.564^{***}	1.218	0.192	6.332^{***}
7.	Irrigation source	0.107	0.851	0.535	1.592^{NS}
8.	Farm power status	0.126	0.020	0.035	0.578^{NS}
9.	Contact with extension agency	0.419^{***}	0.132	0.035	3.714^{***}
10.	Information seeking behaviour	0.380^{***}	0.020	0.019	1.020^{NS}
11.	Social participation	0.299^{***}	0.021	0.013	1.620^{NS}
12.	Fatalism	0.131	0.095	0.088	1.085^{NS}
13.	Innovativeness	0.341^{***}	0.583	0.147	3.977^{***}
14.	Decision making behaviour	0.154^{**}	-0.001	0.016	-0.080^{NS}
15.	Risk orientation	0.308^{***}	0.054	0.022	2.401^{**}
16.	Awareness	0.409^{***}	0.139	0.037	3.766^{***}
17.	Attitude towards climate change	-0.321^{***}	-0.068	0.032	-2.090^{*}
Sample Size: 200		F = 17.74			
NS -Non significant		R^2 =0.624			
*** - Significant at 0.01 level		Constant=10.499			
** -Significant at 0.05 level					
* - Significant at 0.1 level of probability					

From Table 2, it could be inferred that out of seventeen variables, nine variables *viz.* educational status (X_2), farming experience (X_6), contact with extension agency (X_9), information-seeking behaviour (X_{10}), social participation (X_{11}), innovativeness (X_{13}), risk orientation (X_{15}), and awareness (X_{16}) had shown positive and statistically significant association with knowledge of paddy farmers at one percent probability level. Whereas the attitude towards the influence of climate change (X_{17}) had shown a negative and statistically significant association with knowledge of paddy farmers at the same level of probability.

The variable decision-making behaviour (X_{14}) had shown a positive and statistically significant relationship at five percent probability level. However, variables such as annual income (X_3), occupation (X_4), area under rice cultivation (X_5), irrigation source (X_7), farm power status (X_8), and fatalism (X_{12}) depicted their statistically non-significant relationship with the dependent variable.

The multiple regression analysis was further performed to find out the extent of the contribution of each variable towards the knowledge level of paddy farmers on climate change.

Table 2 depicts the coefficient of determination (R^2) value was 0.624 which revealed that all the selected seventeen variables acted as a cause to bring 62.40 percent variation towards knowledge of paddy farmers.

The 'F' value (17.74) was significant at a one percent level of probability. Since the 'F' value was significant, the prediction equation was fitted for the knowledge level of paddy farmers on climate change and the same is given below.

$$Y = 10.499 + 0.168X_1 + 0.339^{***}X_2 + 0.145X_3 + 0.069X_4 + 0.154X_5 + 1.218^{***}X_6 + 0.851X_7 + 0.020X_8 + 0.132^{***}X_9 + 0.020X_{10} + 0.021X_{11} + 0.095X_{12} + 0.583^{***}X_{13} - 0.001X_{14} + 0.054^{**}X_{15} + 0.139^{***}X_{16} - 0.068^{*}X_{17}$$

Results from Table 2 explained that out of seventeen variables, five variables namely educational status (X_2), farming experience (X_6), contact with extension agency (X_9), innovativeness(X_{13}), and awareness (X_{16}) had shown positive and statistically significant contribution with the dependent variable 'knowledge' at one percent level of probability.

The variable risk orientation (X_{15}) had shown a positive statistically significant contribution at five percent level of probability, whereas the attitude towards the influence of climate change (X_{17}) had shown a negative statistically significant contribution at a ten percent level of probability.

Table 2 further indicated that the strength of the variable can be explained as a unit increase *ceteris paribus* namely educational status (X_2), farming experience (X_6), contact with extension agency (X_9), innovativeness (X_{13}), risk orientation (X_{15}), and awareness (X_{16}) would increase the knowledge level of the respondents by 0.339, 1.218, 0.132,0.583, 0.054, and 0.139 units, respectively.

From this, it could be inferred that the variables namely educational status, farming experience, contact with extension agency, innovativeness, risk orientation, and awareness had a high contribution to the dependent variable knowledge.

The educational status would have an adequate contribution to the knowledge level of respondents on climate change. Educational status is positively related to knowledge level. As the education level of a respondent increases, more would be intended to participate in the search for climate change information.

The farming experience resulted in a significant and positive relationship with the knowledge level of paddy farmers. It is natural that the farmers having more experience in farming activity would have more understanding about climate change. Hence more farming experience supports a greater level of knowledge on climate-based agricultural issues. Extension agency contact had a positive and significant relationship with the knowledge level. The role of extension personnel was to bring about desirable changes among the clientele group. Higher level of extension agency contacts which resulted in more knowledge on climate change. Hence, in the present study, these changes reflected the upgradation of respondents' knowledge level.

Innovativeness was found to have a positive and statistically significant relationship with knowledge. Innovative minds helped the respondents to adopt new cultivation practices or technology. The optimal level of innovativeness always helped the respondents to acquire more knowledge of climate change. Thus, innovativeness supports the knowledge level of paddy farmers. The independent variable risk orientation resulted in statistically significant and positive relationship with the knowledge level. Farmers having high risk-bearing ability would always like to try new practices, even before they were convinced of their advantages. This might be due to the fact that more risk orientation made anyone progress and also to have in-depth knowledge. Thus, the variable risk orientation exhibited a positive and statistically significant relationship with the knowledge level of paddy farmers.

Awareness was found to have a positive and statistically significant relationship with the knowledge level. Awareness is the state or ability to perceive, feel, or be conscious of an event. When the respondents are aware of changing climatic conditions, more would be intended to gain additional information on climate change. Thus, the result could be substantiated.

Hence it could be inferred that a result of more literacy rate, higher farming experience, extension agency contact, innovativeness, risk orientation, and awareness level of paddy farmers would have resulted in improving their knowledge level.

4. CONCLUSION

More than half of the respondents (55.00%) had a medium level of knowledge of climate change. Nearly one-third (32.50%) of the respondents had a high level of knowledge and a lesser number of respondents (12.50%) were found to be under the category of low-level knowledge. Educational status, farming experience, contact with extension agencies, information-seeking behaviour, social participation, innovativeness, risk orientation, and awareness had shown positive and significant associations with knowledge of paddy farmers and these variables contributed to improving the knowledge level of the Paddy farmers on climate change. They had knowledge of changes in the rainfall patterns, extreme climatic events, changes in the crop growths stages, ground water table, and pest and disease outbreaks but the farmers don't have enough knowledge on climate change adaptation strategies in Paddy cultivation with respect to tackling the problems of salinity, sodicity, and effects of humidity on grain filling to cope up with climate change. Hence, special training may be frequently offered in the study area to improve the knowledge and skill of the farmers on climate change. Further, more number of research study may be taken in the study area to suggest alternate cropping pattern

as well as adaptation measures for salinity. Being the extension research project, the present study suffered from the usual limitations of time**.** It is a qualitative study, which largely relied on the responses received from the farmers about what they knew and felt about. Therefore, the validity of responses and generalizations made out of them may be applicable in similar situations. In spite of these limitations, every effort has been was made to keep this study as objective as possible by deliberately following all the principles of scientific research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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